EFFECT OF LOW TECH TOOLS FOR INCLUSIVE EDUCATION IN MATHEMATICS ON ATTENTION REGULATION, ACADEMIC ACHIEVEMENT AND NUMERICAL ABILITY AMONG THE DYSCALCULIC STUDENTS OF PRIMARY CLASSES

A

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1.0.0 INTRODUCTION

Education is the revolutionary instrument to bring about behavioral change among the students. It is the level of education that helps pupils to earn respect and recognition. In my opinion, it is indispensable part of life both personally and socially. The importance of education is undeniable for every single person. It goes with saying that education has a positive effect on human life. Pupil may become more useful and civilized if better educated. In areas where residents are not able to receive an appropriate education, life cannot be as thriving and prosperous as locations where highly educated population converge. Child education initiates at elementary level. Elementary education covers the primary (6-11 years) and upper primary (11-14 years) age group. The essential goal of a 14-year old child is to acquire basic foundation skills such as the ability to read and write with fluency, numeracy, comprehension, analysis, reasoning and social skills such as teamwork. Equally, elementary education should install courage, confidence, curiosity, independence, resourcefulness, reliance, patience and understanding in pupils. Fulfillment of these goals release upon the knowledge of some important subject such as mathematics which is said to be gateway of knowledge.

Mathematics may be seen as the science of magnitude, number, shape, space, and their relationships and also as a universal language based on symbols and diagrams. It involves the handling (arrangement, analysis, manipulation and communication) of information. Mathematics education provides the child with a wide range of knowledge, skills and related activities that help him/her to develop an understanding of the physical world and social interactions (Binay Pattanayak). It gives the child a language and a system through which he/she may analyze, describe and explain a wide range of experiences, make predictions, and solve problems. Mathematics education fosters creative and aesthetic development, and enhances the growth of reasoning through the use of investigative techniques in a mathematical context (Bisanz et.al, 2005). Mathematics education encourages the child to think and communicate quantitatively and spatially, solve problems, recognize situations by applying mathematics applications and use appropriate technology to support such applications. If the child is to become an informed and confident member of society he must be enabled to deal effectively with the varied transactions of everyday life and make sense of the mass of information and data available through the media, confident and to communicate effectively through the medium of mathematics (Maccini, p., 2000).

The National Policy on Education 1986 describes the importance of mathematics as:
Mathematics should be visualized as the vehicle to train a child to think, reason, analyze and to articulate logically. Apart from being a specific subject, it should be treated as a concomitant to any subject involving analysis and reasoning.
The main goal of mathematics education in primary school is the mathematisation of the child's thought process through joyful learning (Gordana, 2013). The children should learn to enjoy mathematics rather than fear it. They should pose and solve meaningful problems. Teacher should engage every child in the class. Primary school mathematics takes place in a situation where: (1) Children learn to enjoy mathematics, (2) Children learn importance of mathematics, (3) Mathematics is a part of children's life experience which they talk about, (4) Children pose and solve meaningful problems, (5) Children use abstractions to perceive relationships and structure, (6) Children understand the basic structure of mathematics and (7) Teachers expect to engage every child in class.
It has also been realized that acquisition of basic mathematical skills in the early years of primary schooling is very crucial for higher learning in mathematics (Bisanz, 2005). Accordingly Sarv Shiksha Abhiyan (SSA) interventions have attempted to strengthen the early arithmetic development programs in each state by identifying experts and resource agencies working in this area, designing plan of action for ensuring quality math's education in the early years, building capacity of trainers & teachers, undertaking organized numeracy assurance programs for early grades on a large scale and tracking performance of students on a regular basis to sustain their learning continuum (Binay Pattanayak).

Form 2005, ASER (Annual status of Education Report) report shows that about 50% children in Std 5 across India can read Std 2 level texts or higher but the rest are far behind .The ASER numeracy test also for std 5 shows that barely 28% children can do long division while 38% are just about recognize numbers up to 100 but cannot do even subtraction with borrowing (Madhav Chavan). Minimum levels of learning in mathematics, as per NCERT Report 2006 viewed it as experiences to be given only at the beginning of Class I, but rather spread over Class I and Class II as developing readiness for the concepts and problem-solving which are to follow in Classes III-V. Fifth grade is also a year of development and skill building in mathematics**.** By the end of fifth grade students should be able to: Be proficient using the four mathematical operations of

addition, subtraction, multiplication, and division, Use basic algebraic functions such as exponents and order of operations, Apply geometric concepts to solve problems, Use various methods of measurement with skill

Children who can at least do division problems		Children who can at least do Subtraction problems
ASER year	STD V	STD V
2011	27.6	61.2
2012	24.9	53.6
2013	25.6	52.3

This table shows current status of mathematics of 5 std students. Hence researcher has taken 5 std as sample in her research proposal**.** Problems with mathematics start in primary school and persist till adulthood. Considering the fact that mathematics is hierarchical, students who did not understand the previous material will, in addition to their problems in basic mathematics, also experience failure that may eventuate to mathematical anxiety. These combined difficulties appear in the clinical form called dyscalculia (Brain Butterworth, 2010) which is a set of specific difficulties in learning mathematics and in performing mathematical tasks in children with normal intelligence, access to education and without severe psychological problems.

Learning disability or neurobehavioral disorder is a classification including several areas of functioning in which a person has difficulty in learning, usually caused by an unknown factor or factors. "Learning disabilities" is used; to describe a group of disorders characterized by inadequate development of specific academic, language, and speech skills (See & Woo, 2010). People with a learning disability have trouble performing specific types of skills or completing tasks if left to figure things out by themselves or if taught in conventional ways.

The National Joint Committee on Learning Disabilities (NJCLD) defines the term learning disability (Teresa Guillemot, 2000) as: a heterogeneous group of disorders manifested by significant difficulties in the acquisition and use of listening, speaking, reading, writing, reasoning or mathematical abilities. These disorders are intrinsic to the individual and presumed to be due to Central Nervous System Dysfunction. Even though a learning disability may occur

concomitantly with other handicapping conditions (e.g. sensory impairment, mental retardation, social and emotional disturbance) or environmental influences (e.g. cultural differences, insufficient/inappropriate instruction, psychogenic factors) it is not the direct result of those conditions or influences. Students with intellectual and other developmental disabilities educated in general education classrooms demonstrate better performance in reading, math and significantly higher gains in adaptive behavior when compared with students with intellectual and other developmental disabilities educated in separate settings (Tezer et.al, 2009).Thus these students should be included in the general education stream termed as inclusive education. Inclusion in education is an approach of educating students with special educational needs. Under the inclusion model, students with special needs spend most or all of their time with non-disabled students. Students in an inclusive classroom are generally placed with their chronological age-mates, regardless of whether the students are working above or below the typical academic level for their age. Also, to encourage a sense of belonging, emphasis is placed on the value of friendships. Children with special needs, especially children with physical and mental disabilities, have as much right as every other child to learn mathematics, and their needs (in terms of pedagogy, learning material etc) have to be addressed seriously. The conceptual world of mathematics can bring great joy to these children, and it is our responsibility not to deprive them of such education.

There are some types of learning disabilities like Dyslexia, Dysgraphia and Dyscalculia among the pupils. Dyscalculia is a learning disability in children. It is a kind of dyslexia and also known as mathematics dyslexia (David, 2001). Dyscalculia is a mathematical learning disorder where the mathematical ability is far below expected for a person's age, intelligence and education. Researchers have found evidence that such a disability exists and due to their findings there is a need to address dyscalculia as an important educational issue in mathematics (Teresa Guillemot, 2010). Pupils with learning disorders may feel uncomfortable in learning situations, unless they are being treated in a way that facilitates their learning.

Students with dyscalculia have difficulties understanding what numbers mean, remembering math facts, and steps to complete math problems or may have difficulty with visual-spatial concepts used in making patterns or in geometry. Dyscalculia may be related to language processing disorders which result in difficulties learning math vocabulary needed to understand

math concepts and to solve more complex problems (Alireza, 2010). For example, some students may also have difficulties with concepts such as greater than, lesser than, bigger and smaller. Problem faced by the dyscalculic students are

- Difficulty working with numbers
- Confused by math symbols
- Difficulty with basic facts (adding, subtracting, multiplying and dividing)
- Often will reverse or transpose numbers (36: 63)
- Difficulty telling time
- Difficulty with directions (as for playing a game)
- Difficulty grasping and remembering math concepts
- Poor memory for layout of things (for example, numbers on a clock)
- Limited strategic planning skills (like used in chess)
- Relies on tangible supports such as fingers, tally marks
- Slowness in given answers to math questions
- Difficulty with estimation and approximation
- Difficulty finding different approaches to one problem
- Trouble with visualizing patterns, different parts of a math problem, or identifying

Critical information needed in problem solving.

These children are suffered by many problems due to which fear, phobia, anxiety, develop among them. A child with learning disabilities usually gets identified only after he is admitted in the school. As his general performance in non academic areas seems normal so as he does not easily get identified in preschool years. It would be wonderful to be able to test children's behavior and brain patterns in kindergarten, and pick out those at risk for dyscalculia so that they will guided for extra monitoring and tuition. There is even the hope that dyscalculia could be "prevented" in this way. Researches indicate that the mathematics deficiencies of students with learning problems emerge in early years and continue throughout the high school. Thus it is better to identifying students at primary stage; at this stage students are able to understand the basic subject knowledge which is essential for them. If the identification of the student is done at this level then they get the opportunity for diagnosis and remediation because as the age and standard and level increases the complexity of the subject matter also increases with it. At the

higher stages identification and remediation will be tough. To stop these negative effects the diagnosis of the problem is at the primary stage (NIHM Project report).

A diagnosis may have the effect to make a person feel understood, and give an explanation to why it is hard to learn a specific matter. A diagnosis also prevents a person from being discarded as "dumb". The main reason to why research on dyscalculia is conducted is hopefully to give a remedy to the persons with mathematical learning disabilities. A diagnosis of dyscalculia could help the affected children to find a way to not feel excluded from the possibility to understand a core subject like mathematics (Brain Butterworth, 2010).

Thus these students have problems in basic mathematical operations, lack of attention and low academic achievements which causes stress, fatigue, depression, failure in mathematics and suicidal tendencies. To prevent these problem educationists, mathematicians and parents should come forward to deal these students by different methods for learning, teaching and handling them.

Attention Regulation

All human experiences are filtered through many lenses, one of which is attention. Like a magnifying glass, attention emphasizes some information with the natural consequence of excluding other information. Human beings have many powerful sensory perceptions including senses of sight, direction, and touch that provide a constant, potentially overwhelming stream of information to the brain, and the attention regulatory system serves to identify the most important information within that stream by strategically shifting or sustaining attention. Consequently, the system of attention regulation has much power in determining how one interprets and makes meaning of experiences. Attention Regulation is the process of regulating of attention to specific task. Attention regulation is related with the mindfulness. Mindfulness begins by bringing awareness to current experience - observing and attending to the changing field of thoughts, feelings and sensations from moment to moment of - by regulating the focus of attention. This leads to a feeling of being very alert to what is occurring in the here and now. It is often described as a feeling of being fully present and alive in the moment. Skills in sustained attention would be required to maintain an awareness of current experience.

The self-regulation of attention also fosters non-elaborative awareness of thoughts, feelings and sensations as they arise. Due to lack of attention dyscalculic students are not able to follow the instruction which causes poor academic achievement (Ronald,et.al,1999). Problem related with

the attention regulation among the dyscalculic shows: Problem attending to tasks long enough to finish and organize them. Often hear just part of the instructions, get part of the assignment, or have only some of the tools they need in class. Frequently require recuing or repetition of tasks or they find themselves midstream in a task with no idea of where they were heading. The ability to focus and sustain attention on an intended object requires skills involved in monitoring the focus of attention and detecting distraction, disengaging attention from the source of distraction, and redirecting and engaging attention to the intended object. Children with dyscalculia made somewhat more errors on a test of sustained attention and children with dyslexia showed a slightly, but significantly higher error score on a test assessing flexibility (Muhammad,2013). This shows impressively that samples of learning disordered children will often exhibit at least mild attention problems even if children with a clinical diagnosis of ADHD are excluded. For measuring Attention regulation star Counting test (SCT) will be used by the researcher .The SCT was developed within the framework of the model of Working Memory advanced by Baddeley and Hitch, Working memory refers to a system for the temporary storage and processing of information .The system is, up to now, subdivided into three components. The Central Executive (CE) system, of limited capacity, forms the control centre. It can be relieved of part of its functions by subsidiary slave systems, two of which are specified. These are a system to maintain verbal material, and one for spatial material. The CE is, "responsible for initiating and modulating the different mental processes associated with working memory" .Manipulation of control processes is central to the system (De Jong and Das Smaal).

Academic Achievement

Academic achievement or (academic) performance is the outcome of education — the extent to which a student, teacher or institution has achieved their educational goals. Academic achievement is commonly measured by examinations or continuous assessment.

Good performance in mathematics on the other hand is a prerequisite to pursuance of some lucrative career courses at the university level like medicine and engineering. This scenario puts learners with a difficulty of numbers otherwise known as dyscalculia at a disadvantaged position. This is because, these learners are unable to manipulate mathematical concepts under the conditions found in a normal conventional classroom set up. Some British National Curriculum (Muhammmad, 2013) based preparatory schools in Nairobi have endeavored to support these learners by adopting some strategies which are aimed at influencing their academic performance.

The support strategies involved include; differentiated teaching resources, differentiated teaching methods, adjusted tests and differentiated tasks and classroom assignments.

Numerical ability

Numerical ability is defined as the ability to reason and to apply simple numerical concepts. Basic numeracy skills consist of comprehending fundamental mathematics like addition, subtraction, multiplication, and division. Substantial aspects of numeracy also include number sense, operation sense, computation, measurement, geometry, probability and statistics. A numerically literate person can manage and respond to the mathematical demands of life. By contrast, the lack of numeracy or innumeracy can have a negative impact if the skills are absent (Cappelletti, 2001). Numeracy has an influence on career professions, literacy, and risk perception towards health decisions. The first couple of years of childhood are considered to be a vital part of life for the development of numeracy and literacy. Though any deficiencies in initial number sense may affect the early learning, these limits are not fixed. Number sense is of interest as a critical feature of normal mathematics learning, and as a probable source of deficit for those with more severe mathematical difficulties (Geary,et.al, 2009). There are pupils in school with difficulties when it comes to learning mathematics. These pupils are normally functioning, social, intelligent adolescents with seemingly no disorders. But when it comes to mathematics they no longer feel like intelligent well functioning persons that they really are and for some of them their whole world falls apart (Teresa Guillemot, 2010).

Researches' shows that there is also a link between non-symbolic numerical abilities and dyscalculia (Camilla, 2010). The researchers found that the severity of the impairment in non-symbolic numerical skills predicted low performance when symbolic numbers were involved, in accordance with the idea that our mathematical abilities depend on non-symbolic numerical skills (David C,et.al,2001). Difficulties in solving simple and complex arithmetic problems are the defining feature of dyscalculia and Arithmetic Deficit (AD). These difficulties are subsumed under procedural and retrieval deficits. For both AD children and individuals afflicted with dyscalculia, procedural deficits are typically evident during the solving of complex arithmetic problems Dyscalculic students show mistakes while doing calculation, recognition of the numbers, lack of numerical ability while solving the mathematical problem, some time they are confused to select the operation to be applied in the problem (Karin Landerla,et.al,2003).

Difficulty working with numbers, confused by math symbols, difficulty with basic facts (adding, subtracting, multiplying and dividing) and Often will reverse or transpose numbers (36: 63). Children with dyscalculia lack a "number sense"---they have problems relating number symbols to real-world objects and situations thus these students have problem related with numerical ability (T.Nagavalli). Children with LD often have difficulty with symbolic or abstract concepts and reasoning. These students may need extra assistance through hands-on manipulative and pictorial representations of mathematical concepts. Hands-on experiences allow students to understand numerical symbols and abstract equations at a concrete level, making the information more accessible to all students (Maccini,2000).

Low Technical Tools for Inclusive Education

National council of teachers of mathematics (NCTM position) affirms that a high quality, challenging, and accessible mathematics education provides early childhood learners with a vital foundation for future understanding of mathematics. It is necessary for the teacher and teacher educator to come forward to tackle the problem of learning disability in mathematics i.e. dyscalculia by the application or implementation of certain motivational instructional strategies, techniques, method, or programs for the betterment of the students so that they can to live better and attain their proposed goal and positive attitude about mathematics. Such strategies include drawing pictures of word problems, using mnemonics to teach the memorization of mathematics steps and using music to teach mathematical facts. Depending on the type and severity of the disability, interventions and current technologies may be used to help the individual learn strategies that will foster future success. Some interventions can be quite simplistic, while others are intricate and complex. Current technologies may require student training to be effective classroom supports. Teachers, parents and schools can create plans together that tailor intervention and accommodations to aid the individual in successfully becoming independent learners (P.Amiripour, 2012).

There are several technologies, Aids and methods which helps the dyscalculia students. One of the technique is Low Tech tools for Inclusive education i.e. (LoTTIE) It is a kind of Assistive Technology and is defined as any device whether it’s purchased off the shelf, self constructed homemade, or modified, that helps people with special needs to maintain or increase their functional capabilities. Low tech tools for inclusive education help the dyscalculic students in learning mathematics which includes highlighter, easel, large dominoes, foam numbers letters

and symbolic set, magnifying bar, geoboards, talking calculators, transparent relational geosolids, number line desk tape, magnetic math set, fraction pie stamps, addition and subtraction board etc. These Low Tech tools for inclusive Education are different from the Audio Visual aids and instructional material, instructional material is a device which present a complete body of information and largely self supported rather than supplementary in the teaching learning process while teaching aids are supplementary and not self supported and teacher can only use it to make her point clear. Where as low Tech Tools for Inclusive Education is a kind of assistive tool which helps the disabled students in their teaching learning process. It makes learning an enthusiastic and motivational source.

Assistive technology then becomes a tool that provides a method for an individual who is experiencing a disability or other issue to still participate in a classroom. The application of assistive technology in schools for students classified as having a disability is required through laws such as Individual with Disabilities Education Act (IDEA). Assistive technology has the capacity for increasing student independence, increasing participation in classroom activities and simultaneously advancing academic standing for students with special needs, providing them the ability to have equal access to their school environment. As the inclusive education of all students occurs more frequently within the standard classroom, then it becomes important that the knowledge/experience base for all teachers needs to be expanded to incorporate assistive technology approaches and accommodations. The changes in the student population of special needs students, such as students with disabilities and language issues that have occurred in schools in recent years are having a major impact of changing the learning goals, the teaching methods, and the means of assessment for all students. The educational environment needs to be designed or adapted for all students have the opportunity for success, even those students who may need modifications and accommodations.

Teaching with Low tech Tools for Inclusive Education is beneficial for dyscalculic students because

- It increase motivation among the dyscalculic students (Lankuits, 2009) .
- It can be used to help students with dyscalculia to perform better in the classroom.
- It enables students with learning disabilities to learn independently.

- It can also provide the learning disabled students with remedial and compensatory support (P.Amiripour,2012).
- It can improve and enhance numerical ability.
- It can improve and enhance visual spatial perception ability.
- It can improve learning of symbols and numbers.
- It can develop ease in learning time and direction.
- It can increase the pace of learning of mathematics.
- It can develop positive attitude among dyscalculic students.
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1.1.0 EMERGENCE OF THE STUDY

Universalisation of schooling has important implications for mathematics curriculum. Mathematics being a compulsory subject of study, access to quality mathematics education is every child's right. We want mathematics education that is affordable to every child, and at the same time, enjoyable. On the other hand, mathematics education in our schools is beset with problems. We identify the following core areas of concern: A sense of fear and failure regarding mathematics among a majority of children. Children with LD often have difficulty with symbolic or abstract concepts and reasoning. WIPRO-Educational Initiatives 'Quality Education Study,' which covered 89 schools, shows a fall in learning standards among students in classes 4, 6, and 8 over the last five years, it also flags a disturbing deficit of social sensitivity on the part of a sizable section of students (K. Venkataramanan). Responses to some questions relating to the education of girls and attitudes towards immigrants, the disabled and HIV-positive patients, indicated biases that could, over time, grow into prejudices. Exploring the mind of the young at a formative stage in this way, which some might consider methodologically challengeable, is a particularly valuable part of study (Mix,k et.al, 2002). It will be a serious mistake to ignore the broad trend that indicates misconceptions of early years being carried on to a higher age and the possibility of these children imbibing biases they see in their family atmosphere or social settings.

Sarva Shiksha Abhiyan (SSA) aiming for universalisation of quality elementary education for each child in the 6 to 14 age group has undertaken several initiatives to improve the quality of mathematics education both at Primary and Upper Primary level. *L*earning outcomes in

Mathematics both at Primary and Upper Primary level as depicted by various independent learning assessment studies do not reveal a satisfactory situation in mathematics education at the elementary level, thus in SSA emphasis is given on quantitative education where as we are lagging behind in the qualitative education i.e. our students are lagging behind in many quantitative aspects of fundamental education. In order to solve everyday problems it is necessary to use many skills that include a set of rules and algorithms (Binay Pattanayak) . Moreover, formal education, daily living activities and jobs require knowledge and application skills of counting and simple mathematical operations related to addition, subtraction, multiplication and division.

Problems related to the primary education were as follows:

Students having difficulty with vocabulary in mathematical problems. Students lacking confidence when solving mathematical problem. Students are confused on the proper process to be used while solving problems. Students are not having fundamental conceptual knowledge of mathematics before starting secondary school.

Learning disability (LD) is common problem in the present world. Learning disabilities (LD) are characterized by a significant difference in the child's achievement in some areas, as compared to his or her overall intelligence (Kroesbergen, 2003) . 64.3% students up to class 8^{th} are not able to read the watch and 41.9% of students are not able to count the money, this is the present status in learning disabilities in our primary system so how far they are able to interpret mathematical concepts in daily life.

Learning disabled people who have difficulty in calculations and numerical application are known as Dyscalculic students. Dyscalculia may be related to language processing disorders which result in difficulties learning mathematics vocabulary needed to understand mathematical concepts and to solve more complex problems (Teresa Guittemot,2010).They use fingers and other instruments to calculate and solve problems.

The present study is an attempt to find out solution for the dyscalculic students who linger on with a number of questions:

1. Why primary class students are lagging behind with respect to quality in education?
2. Why don’t we solve mathematical problems as others in the class?

3. Why don't we cope up with simple concepts in mathematics and apply them in other problems?
4. Why don't our teachers pay attention on us?
5. Is there any possibility for us to become an equal participant as normal children?
6. Is there any chance to overcome the obstacles in learning mathematics?
7. Is there is any method or technique to solve the problems for the people like us?

Hence the researcher wants to find out the solution for the above questions for the quality development of the primary school children especially in the subject of mathematics which lays foundation for all the subjects.

1.2.0 STATEMENT OF THE PROBLEM

Effect of Low Tech Tools for Inclusive Education in mathematics on Attention Regulation, Academic Achievement and Numerical Ability among the Dyscalculic students of primary classes.

1.3.0 JUSTIFICATION OF THE PROBLEM

Mathematics is a gateway of all the sciences. Mathematics teaching begins at pre-school or primary school and then it continues during a long period. Mathematics gives mathematical information abilities for daily life necessities. Making children more versed in the literacy and basic arithmetic (number sense, recognition of numbers, basic operations) are the prime objectives of the primary education. Quality of primary education holds the key to further learning and achievement of the individuals and society at large.

The attention and emotional components generally serves as the building block for fixed impression about mathematics. Recent cognitive (neuro) science conceptualizations of attention. Both Western scientists and Buddhist scholars recognize that the ability to focus and sustain attention on an intended object requires skills involved in monitoring the focus of attention and detecting distraction, disengaging attention from the source of distraction, and (re)directing and engaging attention to the intended object. These capacities have been associated with dissociable systems in the brain thus these dyscalculic students have attention problem. There is increasing

evidence that attentional problems place students at increased risk for deficits in arithmetic rather than reading. They reported arithmetic computation as the area in which students with attentional problems were most likely to show diminished classroom performance (Ronald 1999). Number sense skills include an ability to rapidly identify small numbers, recognize number order, reason about simple transformations (for example, adding and subtracting one), exhibit counting skills and apply counting to solve number problems. Number sense capabilities are related to achievement in school (Bisanz,2005). These students may need extra assistance through hands-on manipulative and pictorial representations of mathematical concepts. Hands-on experiences allow students to understand numerical symbols and abstract equations at a concrete level, making the information more accessible to all students (Maccini,2000).

Table 1.1 Exhibiting the summary of International research

S.No	**Researcher**	**Research Problem**	**Findings of the research**
1	Muhammad Awwal Yusha'u(2013)	Investigating and Remediating Gender Difference in Mathematics Performance among Dyslexic and Dyscalculic Learners in Sokoto State, Nigeria.	The findings indicated that the treatment given on the groups was significantly effective on dyslexic and dyscalculic students and confirmed no gender difference in academic performances at both pre-test and post-test levels.
2	P. Amiripour et.al (2012)	The Effects of Assistive Technology on Increasing Capacity of Mathematical Problem Solving in Dyscalculia Students	The results indicated that this technology has effect on the performance of these students.
3	Seo and Woo (2010)	The identification, implementation and evaluation of critical user interface design features of computer-assisted instruction program for students	This study indicated that computer-assisted instruction programs would be essential for facilitating the mathematical learning of students with learning

		with learning disabilities.	disabilities.
4	Brian Butterworth & Diana Laurillard (2010)	Low numeracy and dyscalculia: identification and intervention	This study describes straight forward ways of identifying this deficit, and offer some new ways of strengthening the sense of number using learning technologies
5	Geary et al. (2009)	Predicting Mathematical Achievement and Mathematical Learning Disability With a Simple Screening Tool - The Number Sets Test.	This study supports the idea that mathematical abilities rely on rudimentary numerical skills that predate verbal language.
6	Tezer and Kanbul (2009)	Opinions of teachers about computer aided mathematics education who work at special education centers	Argued that computer provides a lot of possibilities for disabled students to improve their mathematical abilities.
7	Lankuits and Kennedy (2002)	Assistive technology and the multiage classroom	They introduce the kinds of special software and hardware for LD students. AT can promote the cooperation and motivation spirit for LD students.

Table 1.2 Exhibiting the summary of National Researches

S.No.	Researcher	Research Problem	Finding of Research
1	Alireza Beygi et.al(2010)	A Remedial Intervention for Addition and Subtraction in Children with Dyscalculia	They indicated a significant increase in the subtraction and addition performance after remedial intervention of dyscaiculic
2	T.Nagavalli & P. FidelisPauline Juliet,(2009)	Technology for dyscalculic chidren	Children with dyscalculia lack a "number sense"---they have problems relating number symbols to real-world objects and situations thus these students have problem related with numerical ability

The dyscalculic students face many conflicts from their teachers, peer group and community .Primary classes are the stage of dreams according to which steam line their future education and increase their intellectual abilities. Very less work has been done in Indian context so the researcher is wants to study about the solving learning problems of dyscalculic students.

1.4.0 OPERATIONAL DEFINITION OF THE TERMS

Low Tech Tools for Inclusive Education

Low Tech Tools for Inclusive Education are defined as any device whether it's purchased off the shelf, self constructed, homemade, or modified, that helps people with special needs maintain or increase their functional capabilities in mathematics for dyscalculic students of primary classes.

ATTENTION

According to Dictionary of Education(1959) "Attention is the attribute or state of sensory clearness."

According to Dandapani.S (2000) "Attention can be described as the selective activity of human organism where by ones conscious is focused upon a specific narrow field to the exclusion of everything else in the environment."

REGULATION

According to Random House Dictionary (1993) "The term Regulation refers to the act of regulating or state of being regulated."

Operational Definition of Attention Regulation

Attention Regulation is the process of regulating of attention to specific task.

ACADEMIC

According to New Oxford Dictionary of English "The term refers to relating to education and scholarship."

ACHIEVEMENT

According to New Oxford Dictionary of English "The term refers, a thing done successfully with efforts, skills, and courage.

Operational Definition

Academic achievement is the achievement of students in the period of learning, exercise and is measured by examination in mathematics.

NUMERICAL

According to New Oxford Dictionary of English "The term refers to related to and having ability to think in or work with numbers."

ABILITY

According to New Oxford Dictionary of English "The term refers to capacity of doing things."

Operational definition of Numerical ability

Numerical ability is an ability which includes number sequence, basic arithmetic and simple mathematics.

DYSCALCULIC STUDENTS

According to Butterworth ,2006 The complexity of numerical processing has made defining what it means to have a specific mathematical learning disability (dyscalculia) difficult.

The National Numeracy Strategy (DfES, 2001) offers the following definition: 'Dyscalculia is a condition that affects the ability to acquire arithmetical skills.

Operational definition

Students of class v having difficulty in gaining number sense, basic mathematical operation in mathematics learning.

1.5.0 OBJECTIVES OF THE PROBLEM

1 To identify Dyscalculic students in primary classes.

2 To prepare Low Tech Tools for Inclusive Education.

3 To study the effect of Low Tech Tools for Inclusive Education in Mathematics on the Academic Achievement of Dyscalculic students.

4 To study the effect of Low Tech Tools for Inclusive Education in Mathematics on the Attention Regulation of Dyscalculic students.

5 To study the effect of Low Tech Tools for Inclusive Education in Mathematics on the Numerical Ability of Dyscalculic students.

1.6.0 DELIMITATIONS

The Study will be delimited in the following ways:

1. The study will be conducted in Agra only.
2. The study will be conducted for primary school students only.

3. Only those Low Tech Tools for Inclusive Education which are related to mathematics will be used in the study.
4. The study will be confined to the subject of mathematics only.

VARIABLES USED IN THE STUDY

The variable of the study has been classified as follows:

Independent variable: In the present study Low Tech Tools for Inclusive Education in mathematics has been taken as an independent variable as its impact will be seen on the other variables of the study.

Dependent variables: In the present study Attention Regulation, Academic Achievement and Numerical Ability will be selected as dependent variables.

Controlled variable: Teaching of Mathematics is done by the researcher in the experimental and control group, Age (10-12), Class V students, intelligence level because all these students are dyscalculic.

1.7.0 HYPOTHESES OF THE STUDY

1. There is no significant effect of Low Tech Tools for Inclusive Education in mathematics on the Attention Regulation of Dyscalculic students of primary classes.
2. There is no significant effect of Low Tech Tools for Inclusive Education in mathematics on Academic Achievement of Dyscalculic students of primary classes.
3. There no significant effect of Low Tech Tools for Inclusive Education in mathematics on the Numerical Ability of Dyscalculic students of primary classes.

1.8.0 METHODOLOGY OF THE STUDY

The methodology of the study has been stated in the following heads:

1.8.1 METHOD OF THE STUDY

Experimental Design will be used by the researcher in the present study. When students stand under control of researchers and they won't indicate real behavior then researchers have used of -

experimental method. In this method, researcher selected two groups as control and experimental randomly. Traditional teaching method will be used by the researcher to teach the control group where as teaching with Low Tech Tools for Inclusive Education in mathematics will be used by the researcher to teach the experimental group. In both the groups teaching is done by the researcher.

The process of experimental method can be drawn into following Phases

Phases of Experimental Method in the Present study	
Developmental Phase	In this phase researcher will prepare lesson plans with the Low Tech Tools for Inclusive Education for mathematics, based upon the 5 chapter which are shown below in the table to teach the Experimental group. Some of the tools are prepared by the researcher and some of the tools are purchased from an Organization. For measuring attention regulation, academic achievement and numerical ability self made tests will be developed by the researcher. Both the groups will undergo in the process of administration of pre tests.
Experimental Phase	In this phase researcher will teach the dyscalculic children with Low Tech Tools for Inclusive Education in mathematics that will provide them the opportunity to explore attention regulation and number sense in the experimental group and traditional teaching method will be applied by the researcher in the control group. In both of the groups teaching will be done by the researcher. After completion of teaching period both groups will go under the process of administration of post test.

Controlled Phase	60 lesson plans will be delivered in 60 days to the dyscalculic students in both the groups by the researcher. A period of 30 minutes will be considered for each and every lesson plan for teaching mathematics.

The following design will be followed by the researcher to accomplish the desired objectives of the research

Groups	Pre –test	Treatment	Post –test
Experimental Group	Pre test for Academic Achievement, Attention Regulation and for Numerical ability administered on this group.	Teaching with Low Tech Tools for Inclusive Education in mathematics	Post test for Academic Achievement Attention Regulation and for Numerical ability administered on this group
Control Group		Teaching through traditional method	

Figure 1.1 Exhibiting Sampling Procedure

Tentative format of teaching of mathematics in both groups (Experimental and control)

Topic		**Days**
1	**Number operation**	**1-10**
2	**Fraction**	**10-20**
3	**Data Analysis**	**20-30**
4	**Geometry**	**30-45**
5	**Measurement**	**45-60**
Total topics ==5		**Total days =60**

1.8.2 SAMPLE:

The researcher listed all the primary schools of the Agra city. As per the requirement of the study researcher will select 10 primary schools by the purposive method. A sample of 80 students with dyscalculia of Class V from 10 schools located in Agra will be taken for the present study. Sample of 80 will be drawn by conducting diagnostic test on an average 500 students of Class V. Purposive sampling technique will be used by the researcher for the experimentation phase. A group of 40 dyscalculic students taken as experimental group and 40 dyscalculic students were taken under control group.

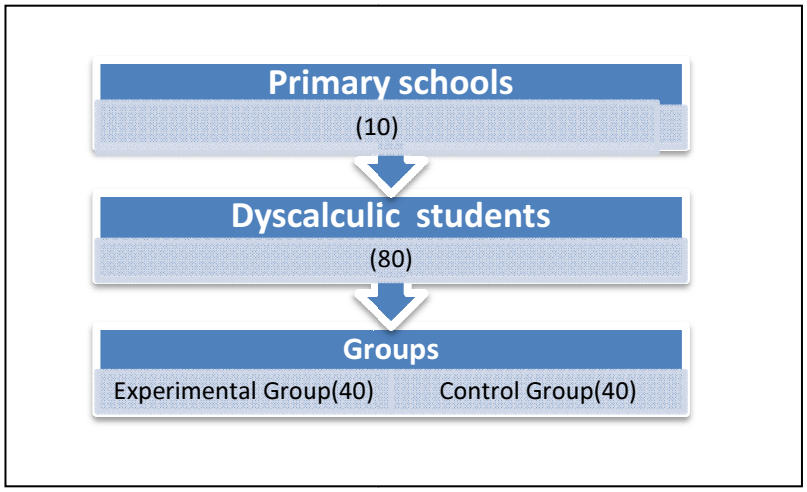

Figure 1.2 Exhibiting Sampling Procedure

1.8.3.Tools:

The following tools will be used for collection of required data:

1. Low Tech Tools for Inclusive Education for mathematics will be self constructed or purchased from reputed National and International Organizations constructing LoTTIE tools for Inclusive Education.

2. A self-made test along with learning disabled battery developed by (Rajshree Bhargava and R.L. Bhardwaj) will be used by the researcher for identification of dyscalculic students of primary classes.

Justification of the tool- Researcher will prepare the tool for identification of dyscalculic students because on the basis of learning disabled battery one cannot identify the dyscalculic student. Identification of these students will be done upon following points.1)Teacher administer check list base upon 3 std mathematics text book because these students are lagging behind by 2 years.2)Measure the child's current Achievement in basic skills.3)Remarks of teachers drawn from parent teacher meeting.4)Analyze how the child learns.

3. A self-made achievement test will be used by the researcher to study the effect of Low Tech tools for Inclusive Education on academic achievement of dyscalculic students of primary classes

Justification of the tool- Researcher will prepare a self made test for academic achievement to study the effect of Low Tech tools for Inclusive Education on Academic achievement of dyscalculic students of primary classes. Achievement test will be prepared by the researcher on the basis on 5 chapters (table 1.1) of their text book which are taught by the researcher in both group during experimental phase during.

4. For measuring attention regulation star counting test (children form) prepared by De Jong and Das Smaal will be modified by the researcher in the simpler form to make it suitable for dyscalculic students. It will be based upon working memory postulated by Baddeley and Hitch. The test requires the control and alternation of two simple processes: forward and backward counting.

5. A self-made test of numerical ability will be used by the researcher to study the effect of Low Tech tools for Inclusive Education on numerical ability of dyscalculic students of primary classes.

Justification of the tool- Researcher will prepare the tool of numerical ability to study the effect of Low Tech tools for Inclusive Education on numerical ability of dyscalculic students of primary classes. Numerical ability test will be based upon on number sequences basic arithmetic (addition, subtraction multiplication and division), and simple mathematics

1.9.0 STATISTICAL DESIGN

To achieve the objectives of the study the researcher will be employing the following techniques.

DESCRIPTIVE STATISTICS

Certain descriptive statistics will be used in order to describe the nature and distribution of the scores obtained on the various tests, so following method of statistical analysis will used in the present study:

Mean: The mean value will be computed as a measure of central tendency of the distribution of achievement scores.

Standard Deviation: This will be computed to study the variation in the scores and to do other various computations.

Graphical representation of data: This will be used to interpret the data through the bar diagrams, etc.

INFRENTIAL STATISTICS

Parametric inferential statistics will be used in present investigation to test the various hypotheses of the study, Variance of Analysis (ANOVA) will be applied to draw definite conclusion on the basis of the obtained results.

1.10.0 SIGNIFICANCE OF THE STUDY

Every child has an equal right to be educated as per the constitution and we can't bring about optimum human resource development without upliftment of dyscalculic students. Achievement in mathematics plays a major role in the qualitative development in education. It will be possible to solve the problem of quality education, wastage and to achieve the target of universalization. Universalization doesn't mean to raise the universal enrollment and universal retention. Universalization in its real sense means to reach higher level of learning above minimum level of learning with due consideration of the existing individual difference so as to include children with learning disabilities with open hands.

In our schools many children face problem in mathematics. To discover dyscalculia at an early stage may prevent these children from developing a negative self-image, leading to decreasing interest in mathematics, which in turn can affect the interest in other school subjects in a negative

way. If the parents are involved and aware of the children's difficulties, then the extra support from home can help the children in their learning process. There are many ways to teach mathematics for learning disabled, Never assume a student who has a disability is unable to master the concepts and operations of mathematics, understand the reason for existing gaps to help why gaps exist is the first step in helping them in grasping the concepts and use good sound instructional strategies like assistive technology, games and cooperative learning.

Low Tech Tools for Inclusive Education serve for students with specific learning disabilities provide a more balanced learning environment for these students. It removes barriers to learning, and encourages these students to participate and interact with their instructors and their peers. Students with various special needs and learning disabilities can use assistive technology services help them and their parents locate, obtain, and use devices as per the student make them attentive in the class, get good scores and be numerically able to solve the problems.

REFERENCES

Annual status for Education Report 2013.

Alireza Beygi, Prakash Pdakannaya and Gowramma, I.P. (2010). A Remedial Intervention for Addition and Subtraction in children with Dyscalculia. Journal of the Indian Academy of Applied Psychology.Vol.36, No 1,09-17.

Binay Pattanayak. Initiatives under the Sarva Shiksha Abhiyan for improvement in basic Numeracy skills among children in the early grades, Sarva Shiksha Abhiyan, MHRD. New Delhi, India.

Bisanz, J., Sherman, J. L., Rasmussen, C., & Ho, E. (2005).Development of arithmetic skills and knowledge in preschool children. In J. I. D. Campbell (Ed.), Handbook of mathematical cognition. (pp. 143–162).New York, NY: Psychology Press.

Brian Butterworth.,Diana Laurillard.(2010).Low numeracy and dyscalculia: identification and intervention, ZDM Mathematics Education. Springer.

Cappelletti, M., Butterworth, B., & Kopelman, M. (2001). Spared numerical abilities in a case of semantic dementia. Neuropsychologia, 39, 1224–1239.

Camilla K. Gilmore a, Shannon E., McCarthy b (2010).Non symbolic arithmetic abilities and mathematics achievement in first year of formal schooling. Learning Sciences Research Institute, University of Nottingham, U.K. Department of psychology, Harward University, USA.

David C. Geary and Mary K. Hoard.(2001). Numerical and arithmetical deficits in learning-disabled children Relation to dyscalculia and dyslexia. Learning Disability and Arithmetic. University of Missouri*, USA.*

Geary D., Bailey D. and Hoard M. (2009). Predicting Mathematical Achievement and Mathematical Learning Disability with a Simple Screening Tool - The Number Sets Test. University of Missouri. Journal of Psychoeducational Assessment, Volume 27, Number 3.

Educating Children's with Learning problems in Primary schools Resource book for teachers, (NIMH) National Institute for Mentally Handicapped (2003).

Gowramma, I.P. (2005). Development of remedial instruction program for children, with dyscalculia in primary school. (1st Ed).Mysore: Chethana book house.

*G*ordana Jovanović1.(2013).The Frequency of Dyscalculia among Primary School Children. Psychiatria Danubina. Vol. 25, No. 2, Pp 170-174.

Karin Landerla, b, Anna Bevana, Brian Butterwortha.(2003). Developmental dyscalculia and basic numerical capacities: a study of 8–9-year-old students. Elsevier.

Kroesbergen, E.V., VanLuti, J.E., & Naglieri, J.A. (2003). Mathematical learning difficulties and PASS cognitive processes. Journal of Learning Disabilities*, 36*, 572-574.

Lankuits, T., Kennedy, K.(2002).Assistive technology and the multiage classroom. Technology and learning journal. 38-45.

Maccini, P. & Gagnon, J.C., (2000).Best practices for teaching mathematics to secondary students with special needs. Focus on Exceptional Children, *32*, 1-22.

Madhav and Benerji, (2012).The challenges of achieving Desirable Levels of Learning in Elemantary Education. Journal of Governance.

Mix, K., Huttenlocher, J., & Levine, S. C. (2002). Quantitative development in infancy and early childhood. New York, NY: Oxford University Press.

Muhammad Awwal Yusha'u.(2013). Investigating and Remediating Gender Difference in Mathematics Performance among Dyslexic and Dyscalculic Learners in Sokoto State, Nigeria, Journal of Education and Practicewww.iiste.org .Vol.4, No.8,.

P. Amiripour et.al, *2012,* The Effects of Assistive Technology on increasing capacity of Mathematical Problem Solving in Dyscalculia Students Journal of Applied Mathematics, Islamic Azad University of Lahijan, Vol.8, No.4(31), pp 47-55.

P. F. De Jong and E. A. Das-Smaal,(1989) The Star Counting Test: An Attention test for children,Department of Cognitive Psychology, Free University, De Boelelaan 1 I1 I,1081 HV Amsterdam. The Netherlands.

Ronald L. Lindsay et.al.(1999).Impact of attentional dysfunction in dyscalculia Developmental Medicine & Child Neurology. 41: 639–642.

Seo, You-jin, Honguk, woo. (2010).The identification, implementation and evaluation of critical user interface design features of computer-assisted instruction program for students with learning disabilities. korea university. 55.

Tezer, M., Kanbul, S. (2009). Opinions of teachers about computer aided mathematics education who work at special education centers. Procedia Social and Behavioral Sciences. 390–394.

Teresa Guillemot.(2010).Dyscalculia – An Overview of Research on Learning Disability, Teacher Education Programme. Mathematics and Computing toc99001@student.mdh.se.

VanLuti, J.E., & Naglieri, J.A. (1999).Effectiveness of the MASTER program for teaching Special children multiplication and division. Journal of Learning Disabilities, 32, 98-107.